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SELF-EVALUATION BY PHYSICAL SCIENCE INSTRUCTORS.

BY- SIMPSON, RAY H.

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THE REPORT OF THIS INVESTIGATION COLLECTED AND DISSEMINATED SELF-EVALUATION TECHNIQUES FOR PHYSICAL SCIENCE TEACHERS AND DISCUSSED THE USE OF SUCH TECHNIQUES. A TOTAL OF 292 PHYSICAL SCIENCE INSTRUCTORS COMPLETED A QUESTIONNAIRE REQUESTING INFORMATION ON THE USE OF 17 SELF-EVALUATION TECHNIQUES. REPORTING THAT A TECHNIQUE WAS FOUND TO BE "VALUABLE," "DOUBTFUL," OR "NO VALUE," AND "MIGHT BE INTERESTED IN TRYING IT." THE USE OF SELF-EVALUATION PROCEDURES BY PHYSICAL SCIENCE INSTRUCTORS WAS ALSO COMPARED TO THE USE OF SUCH TECHNIQUES BY INSTRUCTORS IN OTHER FIELDS. THE AUTHOR CONCLUDED THAT (1) THE USE OF SELF EVALUATION TOOLS AMONG PHYSICAL SCIENCE TEACHERS IS WIDESPREAD, (2) THE MOST USED TOOLS ARE NOT THE ONES WITH THE HIGHEST SUCCESS RATIOS, AND (3) MOST COLLEGE INSTRUCTORS ARE UNFAMILIAR WITH MANY AVAILABLE SELF-EVALUATION TOOLS. THIS ARTICLE IS PUBLISHED IN "SCIENCE EDUCATION," VOLUME 50, NUMBER 1, FEBRUARY 1966. (RS)

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CLARENCE M. PRUITT, Editor
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SELF-EVALUATION BY PHYSICAL SCIENCE INSTRUCTORS

RAY H. SIMPSON

College of Education, University of Illinois, Urbana, Illinois

ALL physical science professors who are concerned with the improvement of their instruction make use of self-evaluation. Such evaluation has taken many different forms. Sometimes it is simply a rather vague feeling by the instructor that something is wrong with his teaching and that possibly changes should be made. With other professors the self-evaluation has been based more on thought than on feeling and more on careful and critical self-diagnosis of specific teaching behaviors which possibly should be changed to produce improvement. With the great influx of students and the concomitant increase in instructors, the problem of self-evaluation in the improvement of instruction has assumed increased proportions.

The materials reported in this study deal with some of the tools and procedures which thoughtful teachers of physical sciences can use for the improvement of instruction. More specifically, the primary purposes of this article are:

1. To indicate self-evaluation tools which the physical science instructor can consider using for the improvement of his instruction.
2. To present a picture of tools which deans of instruction and department heads may wish to suggest to staff members, particularly members who need help on the improvement of their instruction and those who are young or new to the staff.
3. To show the current frequency of use among physical science instructors of certain tools.
4. To show which self-evaluation tools have been found most valuable by physical science instructors who have tried them out.
5. To show which untried tools have the greatest appeal to instructors.

METHOD OF INVESTIGATION

The writer with other members of the Subcommittee on the Improvement of Instruction of The American Association of Colleges of Teacher Education * prepared a list of seventeen "Teacher Self-Evaluation Tools." This list is shown in Table I. The following paragraphs quoted from a letter sent by the Subcommittee to AACTE Institutional Representatives give a picture of how the information reported in this paper was gathered.

> How do your faculty members evaluate their effectiveness as teachers? The AACTE has requests from member institutions asking for suggestions on kinds of teacher self-evaluation approaches which might be used. Your Subcommittee on Improvement of Instruction believes the accompanying questionnaire (the basic part of the questionnaire is shown in Table I) will provide data which will be of help in answering these requests.
>
> In an attempt to emphasize and facilitate instructor self-evaluation of teaching, your Subcommittee on Improvement of Instruction has developed the attached diagnostic tool. It is designed with two purposes in mind: (a) to suggest self-evaluation approaches to staff members, and (b) to help your Subcommittee on Improvement of Instruction to describe current practices.
>
> If you are interested in using this tool with members of your teaching staff, we will supply two copies for each of your staff members to complete. We ask that one completed copy from each staff member be returned to us. We suggest that the other copy be retained by the staff member as a reminder of some of the possible approaches he might want to try in self-evaluation of his teaching.

A total of 292 physical science instructors from 76 institutions returned the completed questionnaire to the AACTE office in Washington, D. C. It should be empha-

* Members of the committee included Harold Hyde, Chairman; Paul M. Allen, William E. Engbretson, Carl Gross, Truman M. Pierce, Herbert Schueler, and Ray H. Simpson.

TABLE I

SELF-EVALUATION TOOLS LISTED IN ORDER OF NUMBER OF 292 PHYSICAL SCIENCE INSTRUCTORS "WHO HAVE USED & FOUND VALUABLE"

"Used; found valuable"	"Used; found of doubtful or no value"	Original number and item on questionnaire	Might be interested in trying
134	12	(7) Comparative check on your efficiency using one teaching approach vs. your efficiency in using another approach.	39
124	1	(13) Voluntary and continuing colleague discussions or seminars by instructors of a particular course.	51
112	7	(12) Visiting in a colleague's class for the purpose of evaluating and improving your own classes.	51
71	39	(1) Evaluative questionnaires or checklists constructed by the teacher to be filled out by your students.	67
56	8	(16) Soliciting the help of administrators or supervisors in evaluating one's own teaching.	36
56	4	(15) Planned meetings with colleagues for the purpose of evaluation of your own and others' teaching.	65
56	45	(2) Open-ended, relatively unstructured, written evaluation by students.	53
55	2	(3) Yearly written recap of own activities and an assessment of the strong and weak aspects of such activities.	56
50	20	(6) Published teacher evaluative instruments.	91
38	4	(17) Systematic search in printed resources for diagnostic tools and procedures for self-evaluation.	42
31	4	(10) Tape recording or TV recording of regular class sessions and then feedback analysis on your part.	85
24	16	(4) Comparative ratings by your students on specified dimensions of your instruction vs. that of other instructors.	60
16	4	(14) Regular luncheons to discuss evaluations of own and others' teaching.	52
14	2	(8) Other action research, in addition to that in No. 7 above, to test teaching efficiency. (Please describe on the back of this sheet.)	5
12	9	(5) Student evaluation committee to provide feedback to the instructor.	50
2	1	(9) Cooperating colleague who near the end of a semester or quarter leads a discussion in your class of strong points and weak points of the class with you absent.	51
2	4	(11) Tape recording of an evaluative class session in which strengths and limitations of classes are analyzed. (This discussion to be led by a student, a panel of students, or by a colleague.)	34

sized that all of these instructors were in institutions which train teachers.

FREQUENCY OF USE OF SELF-EVALUATION TOOLS BY PHYSICAL SCIENCE INSTRUCTORS

A brief statement describing each of the self-evaluative devices and a comprehensive summary of the responses of 292 physical science professors are given in Table I. A clue as to which self-evaluative techniques are most promising is contained in this table, where the tools are ranked in order of the number of successful users. It would seem that those tools with the largest number of satisfied users should be given careful consideration by instructors themselves and by those who want to help teachers improve their instruction. It will be noted that one approach, "Comparative check on your efficiency using one teaching approach vs. your efficiency in using another approach," has been used and found valuable

in the last three years by 46 per cent of the instructors who returned questionnaires.

RANK OF SELF-EVALUATION TOOLS ON A SUCCESS INDEX

The number of successful users of a tool is one measure of its potential value. Another measure can be obtained from the ratio of

$$\frac{\text{Have used and found valuable}}{\text{Have used and found of doubtful or no value.}}$$

For example, it can be seen in Table I that item numbered 15 and item numbered 2 both had the same number of satisfied users, 56. However, item numbered 2, "open-ended, relatively unstructured, written evaluation by students," had 45 dissatisfied users while number 15, "Planned meetings with colleagues for the purpose of evaluation of your own and their teaching," had only 4 dissatisfied users. Hence, number 2 gets a success index rating of 1.2 (56/45) while number 15 gets a very high rating of 14.0 (56/4). It appears that number 15's success index of 14.0 makes it a significantly

TABLE II

RANK OF SELF-EVALUATION ITEMS ACCORDING TO SUCCESSFUL USE BY 292 PHYSICAL SCIENCE INSTRUCTORS

Success Ratio of Tool=Successful users divided by unsuccessful	Original Number and Item on Questionnaire	Percent who "might be interested in trying" tool
124.0	(13) Voluntary and continuing colleague discussions or seminars by instructors of a particular course.	17%
27.5	(3) Yearly written recap of own activities and an assessment of the strong and weak aspects of such activities.	19%
16.0	(12) Visiting in a colleague's class for the purpose of evaluating and improving your own classes.	17%
14.0	(15) Planned meetings with colleagues for the purpose of evaluation of your own and others' teaching.	22%
11.2	(7) Comparative check on your efficiency using one teaching approach vs. your efficiency in using another approach.	13%
9.5	(17) Systematic search in printed resources for diagnostic tools and procedures for self-evaluation.	14%
7.8	(10) Tape recording or TV recording of regular class sessions and then feedback analysis on your part.	29%
7.0	(16) Soliciting the help of administrators or supervisors in evaluating one's own teaching.	12%
7.0	(8) Other action research, in addition to that in No. 7 above, to test teaching efficiency. (Please describe on the back of this sheet.)	2%
5.0	(9) Cooperating colleague who near the end of a semester or quarter leads a discussion in your class of strong points and weak points of the class with you absent.	17%
4.0	(14) Regular luncheons to discuss evaluations of own and others' teaching.	18%
2.5	(6) Published teacher evaluative instruments.	31%
1.8	(1) Evaluative questionnaires or checklists constructed by the teacher to be filled out by your students.	23%
1.5	(4) Comparative ratings by your students on specified dimensions of your instruction vs. that of other instructors.	20%
1.3	(5) Student evaluation committee to provide feedback to the instructor.	17%
1.2	(2) Open-ended, relatively unstructured, written evaluation by students.	18%
0.5	(11) Tape recording of an evaluative class session in which strengths and limitations of classes are analyzed. (This discussion to be led by the instructor, by a student, by a panel of students, or by a colleague.)	12%

"better bet" for those considering the tryout of either. Table II ranks items according to their users' success ratio. In the table is also indicated the per cent who now "might be interested in trying" each tool.

TABLE III

292 PHYSICAL SCIENCE INSTRUCTORS COMPARED WITH OTHER INSTRUCTORS IN USE OF SELF-EVALUATION TOOLS

Subject Field	Average No. of Tools Which Have Been Tried
Psychology	6.61
Preprofessional	5.2
Industrial Arts	5.0
Arts	4.79
Physical Education	4.77
Home Economics	4.75
Education	4.7
Speech	4.5
Biological Sciences	4.40
Music	4.39
Social Studies	4.0
Agriculture	3.95
Commerce	3.93
English	3.8
Physical Sciences	3.6
Foreign Languages	3.3
Mathematics	3.1
Miscellaneous	5.55

TABLE IV

292 PHYSICAL SCIENCE INSTRUCTORS' *Successful Use* OF SELF-EVALUATION TOOLS COMPARED WITH INSTRUCTORS IN OTHER FIELDS

Subject Field	Success Ratio*
Home Economics	10.0
Preprofessional	8.1
Physical Education	7.7
Music	7.2
Education	7.0
Psychology	5.6
Foreign Languages	5.55
Commerce	5.46
Agriculture	5.4
Biological Sciences	5.1
Mathematics	5.03
Speech	4.94
Physical Sciences	4.8
Industrial Education	4.6
Social Studies	4.2
Art	3.9
English	3.7
Miscellaneous	5.54

* Success Ratio=Successful use/Unsuccessful use.

PHYSICAL SCIENCE INSTRUCTORS COMPARED WITH INSTRUCTORS IN OTHER FIELDS

Tables III, IV, and V compare the 292 physical science instructors with instructors in other fields in use (Table III), successful use (Table IV), and press to try tools not tried before (Table V). The information in these three tables probably suggests more questions than they answer. It is obvious from an inspection of these tables that this sample of physical science instructors do not, on the average, make as much use of self-evaluation tools as do those in most other fields. However, the significance of this is not clear. Are instructional fields which are well established from a status standpoint, such as physical science, less interested in critical self-evaluation than those in status-seeking fields? Are the instructors in fields where there is great use of self-evaluation tools more experimentally minded with respect to teaching than those in fields with low ratings? Or do those with high use of self-evaluation tools feel less sure of the efficiency of their teaching? Are those instructors in fields with low ratings too complacent? Do in-

TABLE V

292 PHYSICAL SCIENCE INSTRUCTORS' INTEREST IN "TRYING SELF-EVALUATION TOOLS NOT TRIED BEFORE" COMPARED WITH INSTRUCTORS IN OTHER FIELDS

Subject Field	Number of Tools Average Instructor Might Be Interested in Trying
Physical Education	4.5
Education	4.2
Home Economics	4.0
Industrial Education	3.93
Psychology	3.92
Music	3.86
Commerce	3.8
Agriculture	3.7
Social Studies	3.6
Mathematics	3.55
Speech	3.51
Art	3.50
Biological Sciences	3.3
Foreign Languages	3.2
Physical Sciences	3.0
English	2.8
Miscellaneous	4.7

structors in high rated subjects have greatest dissatisfaction with their teaching? Do low ratings indicate a generally negative reaction to the whole concept of instructor self-evaluation?

Do some fields lend themselves better to the use of self-evaluation tools than other areas? Do physical science professors, for example, put much more stock in their own intuitive judgments than instructors in areas with both a high use and a high success rating? From an examination of Tables III, IV, and V, it would appear that instructors in fields with high ratings such as psychology, are probably more interested in human behavior and interpersonal relations than instructors in areas with low ratings such as physical sciences. If this is true, is that the way it should be?

Another possible explanation for the significantly higher ratings in some fields than in others may lie in basic differences in the incentive structure of different fields. In fields with relatively low ratings, such as physical science, perhaps the value structure is such that improvement in teaching is considered of relatively low importance in the minds of the instructor and of colleagues in his own field. Possibly research or writing in the field is given much greater priority. Possibly these ratings are one index of the relative importance of the teaching professor as opposed to the writing professor as perceived by those in the field.

It seems that there is no doubt that there are significant differences in attitudes toward and use of self-evaluation tools in the physical sciences as compared with other fields. The causes of these differences and the validity of prevailing attitudes in physical sciences and in other fields would seem to merit further study.

ADDITIONAL SELF-EVALUATION PROCEDURES VOLUNTEERED BY INSTRUCTORS

In addition to the seventeen tools for teacher self-evaluation whose current or potential use was evaluated on the questionnaire, 5303 instructors from all fields suggested a total of 27 additional approaches or tools which they had found useful. These additional approaches are indicated below under five categories:

1. Instructor's written assessment of own teaching:
   - (1) Teacher-constructed self-evaluation check list
   - (2) Written instructor evaluation after each class
2. Student achievement in school and out of school:
   - (3) Follow-up of former students in graduate work
   - (4) Structured test to check achievement against objectives
   - (5) Comparison and analysis of student achievement with norms on standardized or teacher-made tests
   - (6) Departmental oral, written, or performance examination of students
3. Work with colleagues:
   - (7) Workshop to construct teacher evaluation instrument
   - (8) Observation and evaluation of classes by invited colleague
   - (9) Questionnaire constructed by faculty committee
   - (10) Interaction through team or panel teaching
   - (11) Use of guidance specialist to help analyze teacher-student social-emotional climate
   - (12) Exchange of material with colleagues or instructors in other teacher-training institutions
4. Adapting from other occupations:
   - (13) Adaptation of evaluative processes from industry or noneducational occupations
5. Use of students:
   - (14) Have nonclass member who is an advanced student observe and evaluate all class sessions
   - (15) Informal discussions with small groups and individual students

(16) Post meeting reaction sheets after each class during selected parts of the term
(17) Class-constructed evaluation instrument
(18) Use of student self-evaluation as one check on instructor efficiency
(19) Class evaluation of its own progress
(20) Eliciting judgments of bright or "reliable" students
(21) Faculty observations of student reactions
(22) "Keeping ear to the ground" for evidences of student reaction
(23) Have one class session devoted to planning for the following year, thereby bringing out student-perceived strengths and weaknesses of current class
(24) Role playing with student assuming role of instructor to help the latter assess student perception of him
(25) A different student each day assumes role of class evaluator
(26) Evaluation instrument prepared by student council or university student committee
(27) Individual conferences with poor students to determine causes of weakness.

It may be noted that the original items on the questionnaire could also be categorized under similar main headings to the five used above.

SUMMARY

This study of the self-evaluation approaches used by 292 college instructors in physical science leads the writer to the following tentative conclusions:

1. Use of teacher self-evaluation tools among physical science instructors is widespread.
2. All but one of the 17 tools which have been tried seem to have more successful users than unsuccessful users.
3. A pronounced difference exists in the degree of successful use among the various tools. (The most successful showed a success/lack of success ratio of 124.0 against the least successful with a ratio of 0.5).
4. The most used tools frequently are not the ones with the highest success ratios.
5. There is a very widespread desire among physical science instructors to try out some tools with which they are currently unfamiliar.
6. Lack of knowledge of how to go about self-evaluation is a restraining factor and this implies the need for professional study and possible guidance from more experienced colleagues or others.
7. The use of self-evaluation tools, their successful use, and the press to try out now tools varies widely depending on the subject-matter field involved. Although the significance of high ratings in the use of self-evaluation tools is debatable, physical science instructors rate lower than those in other fields.
8. The number of self-evaluation approaches is very large. Seventeen were studied intensively here and an additional 27 were suggested by the cooperating instructors. That 44 procedures for self-evaluation are available would certainly come as a surprise to many college teachers.
9. Most college instructors are unfamiliar with many of the available self-evaluation tools.
10. Systematic self-evaluation has excellent potential as a major approach for the improvement of college teaching. More knowledge and study is needed in this area.

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RENSSELAER AND BRIDGEWATER: A Footnote in the History of American Scientific Education

LOUIS I. KUSLAN

Southern Connecticut State College, New Haven, Connecticut

AMOS EATON, "The Old Schoolmaster," has been assigned a high place in scientific education by virtue of his textbooks, his educational writings, and his teacher education program which "carried enthusiasm for natural history in its various branches into many states beyond his little school at Troy, New York."[1] Eaton himself declared that the preparation of "teachers for instructing the sons and daughters of farmers and mechanics, by lectures and otherwise, in the application of experimental chemistry, philosophy and natural

[1] Smallwood, W. M., *Natural History and the American Mind*, New York: Columbia University Press, 1941, p. 249. See also Rezneck, Samuel, "Amos Eaton, 'The Old Schoolmaster' in Precept and Deed," *New York History*, 39:165–178, April, 1958.